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CEREBRAL FUNCTION-IMPROVING COMPOSITION, LEARNING ABILITY-ENHANCING AGENT, MNEMONIC AGENT, DEMENTIA-PREVENTING AGENT, DEMENTIA-TREATING AGENT OR FUNCTIONAL FOOD HAVING CEREBRAL FUNCTION IMPROVING EFFECT

[Nō-kinō Kaizen Soseibutsu, Gakushū Nōryoku Zōkyōzai, Kiokuryoku Zōkyōzai, Chihō Yobōzai, Chihō Chiryōzai mata wa Nō-kinō Kaizenkōka-o yū-suru Kinō-sei Shokuhin]

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TITLE (54): CEREBRAL FUNCTION-IMPROVING COMPOSITION, LEARNING ABILITY-ENHANCING AGENT, MNEMONIC AGENT, DEMENTIA-PREVENTING AGENT, DEMENTIA-TREATING AGENT OR FUNCTIONAL FOOD HAVING CEREBRAL FUNCTION IMPROVING EFFECT

FOREIGN TITLE [54A]: NŌ-KINŌ KAIZEN SOSEIBUTSU, GAKUSHŪ NŌRYOKU ZŌKYŌZAI, KIOKURYOKU ZŌKYŌZAI, CHIHŌ YOBŌZAI, CHIHŌ CHIRYŌZAI MATA WA NŌ-KINŌ KAIZENKŌKA O YŪ-SURU KINŌ-SEI SHOKUHIN

[Claims] /2*

[Claim 1] A functional food having a cerebral function improving composition, a learning ability enhancing agent, a memory-enhancing agent, a dementia-preventing agent, dementia-treatment agent or cerebral function improving effect having as an active ingredient at least one or more types of docosahexaenoic acid, eicosapentaenoic acid and an n-3 group fatty acid of α-linolenic acid and a phospholipid made up of at least one type selected from phosphatidyl choline (PC), phosphatidyl ethanol amine (PE), phosphatidyl serine (PS), phosphatidyl inositol (PI) or liso compounds of these.

[Claim 2] A functional food having the cerebral function improving composition, learning ability enhancing agent, memory-enhancing agent, dementia-preventing agent, dementia-treatment agent or cerebral function improving effect as described in Claim 1 wherein an n-3 group fatty acid is a fatty acid methyl ester and a fatty acid ethyl ester.

[Claim 3] A functional food having the cerebral function improving composition, learning ability enhancing agent, memory-enhancing agent, dementia-preventing agent, dementia-treatment agent or cerebral function improving effect as described in Claim 1 wherein the n-3 group fatty acid is a triglyceride.

[Claim 4] A cerebral function improving composition, learning ability enhancing agent, memory-enhancing agent, dementia-preventing

* Claim and paragraph numbers correspond to those in the foreign text.

agent, dementia-treatment agent or brain function improving effect as described in Claim 1 which provides 1 mg to 100 g of the n-3 group fatty acid and phospholipid described in Claim 1 per day.

[Detailed Description of the Invention]

[0001]

[Industrial Field] The present invention relates to a substance having an effect which improves the cerebral function, that is, it relates to a functional food having a learning ability enhancing agent, memory enhancing agent, dementia prevention agent, dementia treatment agent or a cerebral function improving effect.

[0002]

[Prior Art] In recent years, a great deal of research and study has been carried out from a variety of vantage points on substances and methods which improve learning ability and memory powers and in improving cerebral function in dementia and the like and the effects of these have been reported on incrementally. According to these, methods improving cerebral function studied thus far are classified into cerebral energy metabolism improvement methods wherein protein is efficiently absorbed in the brain cells, the function of the cells is activated and the cerebrovascular circulation improvement methods wherein the blood flow in the brain is improved and the nutrients and oxygen required for the brain cells is sufficiently supplied and research on drugs and therapies having the various pathological actions is being carried out. Moreover, cerebral impairment

(dementia) is recognized and divided into two types: Alzheimer-type dementia wherein impairment of the nervous system is brought about and cerebrovascular dementia wherein cerebrovascular impairment is brought about and research on drugs and therapies for these is being carried out.

[0003] In the case of the former Alzheimer's disease, production of acetyl choline which is a neural transmission substance is known to decline conspicuously as a neurochemical change in the brain. The physiological function is restored by supplementing the metabolism of the choline group which has declined as a method of prevention and treatment of this disease. Examples of these are disclosed in PCT Patent Application Publication 56-500374 "Method and Composition Used to Treat Disease by Administering Lecithin"; Unexamined Patent 59-167514) "Composition for Cerebral Function Promotion Agent"; Unexamined Patent 60-214734 "Therapeutic Composition and Therapy for Nerve Impairment and Taxia"; and the like. This means that acetyl choline is provided to the brain through intake of phosphatidyl which is a phospholipid containing choline so that it can be expected to be used for prevention and treatment of Alzheimer's-type dementia and other neurological impairments.

[0004] Moreover, phosphatidyl ethanol amine which is one type of phospholipid is converted to phosphatidyl choline by a methyl group transfer reaction from the S-adenosyl methionine. As a result, the phosphatidyl ethanol amine can be expected to be used as a prevention

and therapeutic agent for Alzheimer's type dementia and other neurological impairments.

[0005] Moreover, in the present invention, the docosahexaenoic acid (hereinafter "DHA") which is one of the active ingredients having the cerebral function improving effect is $C_{22}11_{32}O_2$, has a molecular weight of 328.4 and is a straight chain hexaenoic acid having 22 carbon atoms having two double bonds in positions 4, 7, 10, 13, 16 and 19. The melting point is -44.5 to -44.1. This is contained in large amounts in oils and fats contained in sardines, herring and other fish oils and Euphausiacea. Moreover, it is well known that these are also contained in large amounts in the brain, nerves, retina and other central nervous system cell membranes of mammalians. According to Rudin, D.O.: Biol. Psychiatry, 16 838-850 (1981), when linseed oil (50 to 60 %) which contains large amounts of an α-linolenic acid which is a DHA precursor is provided to patients with psychiatric illnesses and nervous diseases in a variety of pharmacological therapies, the symptoms are improved. However, when the agent is discontinued, the symptoms are reported to return. However, research in this field, has still not been clarified sufficiently in research either theoretically and in actual practice and, in general, a pronounced therapeutic effect has been confirmed and there are few substances or therapeutic agents which have been put into actual practice.

[0006] Memory enhancing agents and senile dementia therapeutic agents released recently include: (1) a memory enhancing agent (disclosed in Unexamined Patent 56-123915), having 2-(7-indenyl oxymethyl) morphine or an acid added salt thereof as active ingredient; (2) Alzheimer's therapeutic agent (disclosed in Unexamined Patent 58-12123) characterized as made up of a deferroxamine salt with added salt which is pharmaceutically acceptable; (3) a memory enhancing agent (disclosed in Unexamined Patent 58-170719) containing the dipeptide compound represented by H-X-Y-OH (in the formula, X and Y are different, indicating Tyr or Arg); (4) a memory-impairment therapeutic agent (disclosed in Unexamined Patent 61-229823) containing as active ingredient 3.7-dihydro-3-methyl-1-(5-oxohexyl)-7-propyl-1H-purine-2.6-dione and the like; (5) the filing for therapeutic agent for memory diseases of the elderly (published Patent Application 61-501564) and the like.

As Japan turns into an "elder majority country", there is a need to develop substances and drugs not only medically but for society as well.

[0007]

[Problems Which the Present Invention is Intended to Solve] In response to the abovementioned demand, the present invention is a specific functional food which improves cerebral function, enhances learning ability and memory and prevents and treats senile dementia and at the same time has a cerebral function improvement effect.

While carrying out research on the physiological activity and drug activity of docosahexaenoic acid contained in large quantities in oil obtained from herring and sardines and on the physiological activity and drug activity of phospholipids contained in large quantities in phospholipids specifically in marine products such as Euphausiacea, the inventor found through animal experiments, that the mixed composition of these two substances had an extraordinary enhanced learning ability effect and dementia prevention and therapeutic effect, that these were present in part of the constituent ingredients of plants in the natural world, that their safety was confirmed experimentally so that it was extremely useful as a drug and food having a cerebral function improvement effect, and they achieved the present invention. When a mixture of phospholipids and DHA made up of an acetyl choline precursor which is a neural transmission substance inside the brain was administered to rats, it was found that these mixtures had a learning ability enhancement effect, a memory improvement effect and was effective in the prevention and treatment of senile dementia so that a drug and food product could be realized through the present invention.

[0008] Next, we shall explain the abovementioned pharmacological effect in greater detail based on experiments. We specifically carried out experiments on the learning ability enhancing effect and memory enhancing effect using rats fed on animal feed containing as active ingredient oil and fat and lipids containing docosahexaenoic

acid as well as control section rats using a Y maze. This means that we prepared Wistar strain rats, animal feed having as active ingredient a mixture of DHA ethyl ester and phospholipids and a Y maze. We placed the rats in a Y maze and carried out the following experiments on the learning ability enhancement in a mixture of DHA and phospholipids.

[0009] First, we prepared a total of 80 male four-week old Wistar strain rats and divided these into four groups, each group consisting of 20 animals and made four test groups and one control group by differentiating according to the type of feed fed to the animals for the prescribed period. Next, we used as test feed animal feed divided into 4 test groups and one control group in the abovementioned experiment which had been compounded as indicated below. This means that the feed compounded used in the experiment consisted of a raw material having the compounding ratios indicated in Table 1 A and Table 1 B. We used four types of test feed having the differences indicated in Table 2 for the fatty acid composition of the fat which is a constituent ingredient.

[0010]

[Table 1A]

Table 1 A: Constituent Compounding Ratios in Feed	
casein	20 %
minerals	4 %
vitamins	1 %
cellulose powder	4 %
α-cornstarch	61 %
Oils and fats	10 %

[0011]

[Table 1B]

Lipid Composition in Oil and Fat			
	triglyceride	**ethyl ester**	**phospholipid**
Control feed section	100 %	0 %	0 %
D test feed section	0 %	100 %	0 %
E test feed section	0 %	90 %	10 %
T test feed section	90 %	0 %	10 %
R test feed section	0 %	10 %	90 %

[0012]

[Table 2]

Fatty Acid Composition in Oil and Fat (weight %)					
	Control feed section	**D test feed section**	**E test feed section**	**T test feed section**	**R test feed section**
14:0		0.1	2.5	4.6	0.6
16:0	11.5	4.6	3.8	5.7	8.6
16:1 (ω-7)			2.2	9.8	4.1
18.0	0.9	1.3	1.5	1.0	15.1
18:1 (ω-9)	3.3	19.9	20.6	9.3	5.4
18:2 (ω-6)	68.8	17.5	16.8	5.0	0.4
18:3 (ω-3)	14.1			3.5	
20:0	0.2				
20:1 (ω-7)	0.5			1.6	0.1
20:2	0.1				
20:4 (ω-6)	0.3			6.3	12.0
20:5 (ω-3)		10.9	8.8	17.7	17.0
21:1		1.7			
22:5 (ω-3)		3.4	5.2	3.3	0.7
22:6 (ω-3)		37.2	38.6	32.2	36.0

*control feed section: feed containing mixture of safflower oil and olive oil

*D test feed section: feed with ethyl ester containing DHA mixed in as an active ingredient

*E test feed section: feed with ethyl ester containing DHA and phospholipid mixed in as active ingredient

*T test feed section: feed with triglyceride containing DHA and phospholipid mixed in active ingredient

*R test feed section: feed with phospholipid containing DHA mixed in as active ingredient

[0013]

[Experimental Example 1] Experiment on Learning Ability Enhancement Effect and Memory Enhancement Effect for {Group with Mixture of Ethyl Ester Containing DHA and Phospholipids}

We carried out preliminary breeding of 20 male Wistar strain four-week old rats for one week. Then, we bred them using a test feed (E test feed section in Table 2) consisting of a mixture made by mixing ethyl ester containing DHA and phospholipid for 11 weeks. Then, we carried out the main experiment after placing the animals in separate breeding cages and carried out "shapping" [sic] so that the weight of the rats was 85 % at 2 weeks. As indicated below, the rats bred using the E test feed were known as the "E test feed group". The experiments were carried out for 18 days by feeding 20 of the E test feed group rats (experiment carried out a total of 100 times a day) five times a day for each rat in the E test feed group and we measured them.

[0014] The method used for the experiments involved first of all placing the animals at a departure point. Then, the animals started exploratory movements and after a while, they reached the selection point. However, they either chose the side with feed where the light

was lit or they chose the side without feed where the lamp was not lit up. We considered the animals which were able to reach the side with the feed within 30 seconds from the time they were placed at the starting point as having made the right decision and the rats which entered the side with no feed for a longer period of time as having made the wrong decision. The animals only saw the light when they started at the Y maze selection point and they learned that they could get feed on the side with the light. At the same time, we studied the memory by repeating these on a daily basis. Furthermore, for the sake of comparison, we set up test sections provided with feed consisting of a mixture of safflower oil and olive oil (the control feed section in Table 2) and a feed consisting only of ethyl esters containing DHA (feed section D in Table 2) instead of the feed which was a mixture of ethyl ester containing DHA and phospholipids and we bred the rats. Results are indicated in Figure 1 through Figure 4).

[0015] As indicated in Figure 1, the correct response rate for the E test feed group reached 75 % from the start of the experiment to the 18^{th} day. Compared to the correct response rate for the control test feed group and the D test feed group, it showed an extremely high correct response rate. Moreover, trends in the responses are indicated for the E test feed group in Figure 2, trends for the D test feed group are indicated in Figure 3 and trends for the control feed group are indicated in Figure 4. However, at the beginning, all

of the animals in the three groups liked to move around at night so that R- (number of incorrect responses) was higher than R+ (number of correct responses). However, the R- for the E test feed group declined from around the fifth day. At the same time, R+ increased greatly whereas there was virtually no decline in R- in the control test feed group so that the rate of correct responses did not increase that much. Moreover, there was an increase in median for the correct response rate in the D test feed group in which only the DHA-containing ethyl ester was compounded. This means that when animals fed the DHA ethyl ester group proceeded to the side with the light more quickly than the control feed group, they learned how to get the feed and they remembered this without forgetting it for a number of days. Moreover, it was found that the effect could be enhanced by adding a phospholipid to the DHA ethyl ester. Based on the above, it was determined that (the group given the feed which was a mixture of the ethyl ester containing DHA and the phospholipid) had the most enhanced learning effect and memory effect in the light and darkness discrimination feed taking behavior test carried out using the Y maze.

[0016]

[Experimental Example 2] Experiments on Learning Ability Enhancement Effect and Memory Enhancement Effect of {Group Fed Mixture of Triglycerides Containing DHA and Phospholipids}

We carried out preliminary breeding of 20 male Wistar strain four-week old rats for one week, then bred them using the test feed (T test feed section in Table 2) which was a mixture of triglycerides containing DHA and phospholipids for 11 weeks. Then, we carried out the main experiment after placing the animals in separate breeding cages and carried out "shapping" [sic] [Translator's note: should be "shaping"] so that the weight of the rats was 85 % at 2 weeks. As indicated below, the group of rats feed the T test feed was known as the "T test feed group". The experiment was carried out for 18 days on 20 animals 5 times a day (experiment carried out a total of 100 times per day) for each animal in the T test feed group and we took the measurements.

[0017] This experimental method involved first of all, placing the animals at a departure point. Then, the animals started their exploratory movements and after a short time, they reached the selection point and the animal selected the side which had feed where a light was on or the side where there was no feed and no light. Animals which were able to reach the side where there was feed from the departure point within 30 seconds were considered to have made the correct response and the animals which went to the side where there was no feed which took longer than this were considered to have made the wrong response. The animals learned that when only the light shone at the departure point of maze Y, they could select the feed on the side with the light. We also studied the memory powers by

repeating this each day. Furthermore, for the sake of comparison, we set up a test section which was provided feed (control feed section in Table 2) which was a mixture of safflower oil and olive oil and the feed which contained ethyl esters containing DHA (D test feed section in Table 2) instead of the feed which was a mixture of the triglyceride containing DHA and their phospholipids and we bred the rats. Results are indicated in Figure 5 through Figure 8.

[0018] As indicated in Figure 5, the correct response rate for the T test feed group reached 78 % from the time the experiment was started to the 18^{th} day and the group had a much higher correct response rate than the correct response rate of the control test feed group and the D test feed group. In addition, trends in the responses for the T test feed group are indicated in Figure 6, trends for the D test feed group are indicated in Figure 7 and trends for the control feed group are indicated in Figure 8. However, at the beginning, all three groups preferred moving around at night. However, R- (number of incorrect responses) was higher than R+ (number of correct responses) in the T test feed group and R- declined from around the fifth day. At the same time, R+ greatly declined whereas there was virtually no decline in R- in the control test feed group and as a result, there was virtually no increase in the rate of correct responses. Moreover, there was an increase in the median of the correct response rate in the D test feed group made by compounding only the ethyl ester containing DHA. This means that when the animals in the group which

ate the feed containing the DHA went to the side with the light more quickly than the control feed group, they learned that they could get the feed and learned this without forgetting it for several days. Moreover, it was found that the effect was enhanced by adding a phospholipid to the triglyceride containing DHA. Based on the above, it was determined that the (group fed the mixture of triglycerides containing DHA and phospholipids) had a greatly enhanced learning effect and memory effect in the light and darkness discrimination feed behavior carried out using the Y maze.

[0019]

[Experimental Example 3] Experiment on Learning Ability Enhancement and Memory Enhancement Effect for the {group fed the mixture of phospholipid containing DHA and the ethyl ester containing DHA}

We carried out preliminary breeding of 20 male Wistar strain four-week old rats for one week. Then, we fed them a test feed which was a mixture of DHA containing lipids and DHA containing ethyl esters for 11 weeks (R test feed section in Table 2). Then, we carried out this experiment by placing the animals in separate breeding cages and carried out “shapping” [sic] so that the body weight of the rats at two weeks was
85 %. As indicated below, the group of rats bred using the R test feed was labeled (R test feed group). We carried out the experiments

for 18 days on 20 animals (total 100 experiments per day) five times a day for one animal in the R test feed group.

[0020] This experimental method involves first of all placing the animals at the department point. Then, the animals start exploratory movements and after a short time, they reach the selection point. They either select the side with the feed which is lit up or they select the side with no light and no feed. The animals able to reach the side with the feed within 30 seconds from the departure point are considered to have made the correct response. The animals which reach the side with no feed after 30 seconds or more has elapsed are considered to have made an incorrect decision. When the animals were first able to see the light starting from the departure point in maze Y, they learned that they could get the feed on the side with the light. At the same time, we studied memory by repeating this each day. Furthermore, for the sake of comparison, we set up test sections wherein the animals were given feed (the control feed section in Table 2) which was a mixture of safflower oil and olive oil instead of feed which was a mixture of DHA containing phospholipids, DHA containing ethyl esters and feed (D test feed section in Table 2) consisting solely of DHA containing ethyl esters and we bred the animals. Results are indicated in Figure 9 through 12.

[0021] As indicated in Figure 9, the correct response rate for the R test feed group reached 84 % on the 18^{th} day after starting the

experiments and had a much higher correct response rate than that for the control test feed group and the D test feed group. Moreover, trends in the responses are shown in Figure 10 for the R test feed group, in Figure 11 for the D test feed group and in Figure 12 for the control feed test group. However, as all three groups liked to move around at night at the beginning, R- (number of incorrect responses) was greater than R+ (number of correct responses). There was a decline in R- in the R test feed group from around the fifth day and at the same time, R+ increased greatly whereas there was virtually no decline in R- in the control test feed group so that there was virtually no increase in the correct response rate. Moreover, there was an increase in the median of the correct response rate in the D test feed group where only the ethyl ester containing DHA was compounded alone. This means that when the DHA containing group went towards the light more quickly than the control feed group, they learned that they could get the feed and they kept this in mind without forgetting it for several days. Moreover, it was found that the effect could be enhanced by adding the phospholipids containing DHA to the DHA ethyl ester. Based on the above, it was determined that the feed group fed a mixture of DHA-containing phospholipids and DHA-containing ethyl esters enhanced the learning effect and the memory effect the most in the light-darkness distinguishing feed taking actions using the Y maze. The docosahexaenoic acid was used as the acid itself, however, ethyl

esters, methyl esters and triglycerides may also be used and phosphatidyl choline (PC), phosphatidyl ethanol amine (PE), phosphatidyl serine (PS), phoshatidyl inositol (PI) and other phospholipids may be used.

[0022] The phospholipid used in the present invention may be derived from soybeans as long as it is a vegetable phospholipid; it may be derived from egg yolks as long as it is a plant phospholipid and it may be derived from Euphausiacea. However, it should be an unused marine product resource containing a large quantity of phospholipids which contain a large quantity of DHA. The resource used may be a phospholipid extracted from a resource rich in Euphausiacea. However, the amount of Euphausiacea phospholipid DHA is approximately 20 % so that when highly pure DHA is used to supplement it, it is more effective. The mixture of DHA and phospholipid used in the present invention should be 0.1 % and above and preferably approximately 10 %. The daily amount consumed should be 1 mg to 100 and preferably 1 mg to 10 g. The mixture of docosahexaenoic acid and the ethyl ester thereof, methyl ester, triglyceride and docosahexaenoic acid containing lipid and phospholipid may be used as is as a learning ability enhancing agent, a memory enhancing agent, a dementia treatment agent or a dementia prevention agent. It can be used for a mixture of a pharmaceutically permitted diluent and/or a pharmacologically permitted diluent and/or other pharmacologically

permitted substance in accordance with pharmaceutical formulation practices.

[0023] Moreover, it can be used by shaping into pills and placed it in packaging in dose units. The medication may be formed as a powder, granules, tablets, sugar-coated pills, capsules, pills, liquid formulations, ampoules, injections and the like. Moreover, including sunlight contained in the form of a mixture of a diluent which is pharmaceutically permitted is a means of formulating the medication. Examples of the diluent are an excipient, extending agent, binder, moisturizing agent, disintegrator, surface active agent, lubricant, dispersing agent, buffer, taste modifier, deodorizer, fragrance, preservative, solubilizing assistant, solution, covering agent and the like. Needless to say, however, the diluent is not necessarily restricted to these. Moreover, it may be used in the form of a mixture of one or two or more types of these and the pharmaceutically accepted diluent. This pharmaceutically accepted diluent may sometimes be used as a mixture of other substances having a pharmacological action. It may be formulated by using any well-known method such as mixing an active constituent with a diluent and once it has been granulated, it may be made into a tablet by forming the composition.

[0024]

[Practical Example 1]

First, we shall describe several practical examples of making the formulation in the present invention.

*Tablets

We prepared the tablets by compounding them so that they contained the constituents indicated in Table 3. Furthermore, we coated the pills with sugar although the method is not necessarily restricted to this. Needless to say, the tablets may be covered with another suitable raw material.

[0025]

[Table 3]

Example of Compounding Tablets	
phospholipid	30 mg
docosahexaenoic acid	270 mg
Starch	43 mg
Lactose	250 mg
polyvinyl pyrrolidone	3.5 mg
magnesium stearate	3.5 mg
butylated hydroxy toluene	2 ppm
Total amount	600 mg

[0026] *Hard Capsules

We obtained hard 600 mg capsules using the abovementioned powder which had not been made into tablets.

*Soft capsules

We added 300 mg of ethyl esters containing docosahexaenoic acid ethyl esters (weight ratio of 9:1) and made an anti-oxidant agent using the regular method, packed it in soft capsules and obtained the soft capsules. Furthermore, the purity of the DHA used in the drug should be not less than 50 % of the entire fatty acid composition, preferably not less than 90 %.

[0027]

[Practical Example 2] Next, we shall provide a practical example of the functional food in the present invention. The functional food which is a mixture of docosahexaenoic acid and phospholipids in the present invention is an oil and fat containing not less than 10 % of docosahexaenoic acid. However, the amount contained should be at least 18 % in order to reinforce the docosahexaenoic acid.

*Margarine containing docosahexaenoic acid

We prepared a margarine containing docosahexaenoic acid using the compounding example indicated in Table 4.

[0028]

[Table 4]

Example of Compounding Margarine Containing Docosahexaenoic Acid	
soybean oil	31.4 %
triglyceride containing 25 % docosahexaenoic acid	10.0 %
hardened oil	42.3 %
Monoglyceride	0.25 %
lecithin (phospholipid)	1.0 %
flavor	0.044 %
added water	12.566 %
skim milk	1.0 %
table salt	1.4 %
vitamin E	0.04 %
Total amount	100 %

[0029] We produced a margarine made up of the abovementioned constituents by cooling it and placing it in a [Translator's note: original text unclear, possible typo].

*Mayonnaise containing docosahexaenoic acid

We prepared mayonnaise containing docosahexaenoic acid using the compounding example in Table 5.

[0030]

[Table 5]

Example of Compounding Mayonnaise Containing Docosahexaenoic Acid	
egg yolk (containing 20 % phospholipid)	8.0 %
salad oil	70.0 %
triglyceride containing 25 % docosahexaenoic acid	10.0 %
table vinegar	11.0 %
salt	0.8 %
seasoning	0.2 %
Total amount	100 %

[0031] We prepared mayonnaise compounded as indicated above using a vacuum stirrer.

* Tofu containing docosahexaenoic acid

We placed 55 g of powdered tofu in 395 g of water and dissolved it. Then, we placed it directly on a flame, brought it to a boil, boiled it for 3 minutes and removed it from the flame. We added 50 g of an emulsion having the following composition. We further added 1.5 g of gluconolactone (coagulant), stirred it quickly and covered it. We let it harden at room temperature for 1 hour and produced tofu containing docosahexaenoic acid.

* Emulsion Composition

We prepared an emulsion composition using the compounding example indicated in Table 6.

[0032]

[Table 6]

Example of Compounding Emulsified Composition	
triglyceride containing 25 % docosahexaenoic acid	50 %
sugar esters	0.15 %
casein sodium	1.0 %
Water	48.85 %
Total Amount	100 %

[0033] * Ice Cream Containing docosahexaenoic Acid

We added 7.9 parts of skim milk powder, 20 parts of sugar, 0.2 parts of monoglyceride stearate and 0.2 parts of casein to 6 parts of triglyceride containing 25 % docosahexaenoic acid. We further added water to make a total of 100 parts. We mixed it, heated it to 60°C and mixed it. We made the mixed raw material uniform by using a homogenizing mixer. Next, we heated and sterilized it for 30 minutes at 70°C and immediately cooled it to 0°C. We set the mixture out overnight at that temperature and vigorously mixed it and cooled it to -2°C while ensuring that air was contained. Last of all, we hardened this in a freezer and obtained an ice cream containing docosahexaenoic acid.

[0034]

[Effect of Invention] As indicated above, the present invention enhances the cerebral function by using a cerebral function improving composition having as active ingredient a mixture of docosahexaenoic acid (DHA) and a phospholipid or it restores the cerebral function. We used the pharmacological effect and made a product of it using a drug and functional food raw material. Or it may be used as a product by processing a suitable pharmaceutically permitted carrier, excipient, mixed it with a diluent, solution, dispersion, granules, tablets, injection, capsule, suppository and other desired shaped. Moreover, even if this agent is administered orally in the abovementioned form, needless to say, it may be administered parenterally. Furthermore, when administered, needless to say, the amount administered may be changed depending on the age, weight and symptoms, etc. When a mixture of docosahexaenoic acid and phospholipids which is a substance having a cerebral function improving effect in the form of a drug or a food in the present invention is ingested in the human body, the learning ability is enhanced by the active ingredient and at the same time, the memory is enhanced. Moreover, by using the cerebral function improving composition in the present invention as a drug or when ingested as a food, dementia caused by cerebral impairment is prevented or it brings out to the fullest the effect of a variety of dementia treatments.

[Brief Explanation of Figures]

[Figure 1] A graph indicating the learning process (correct response rate) for the Y maze light/darkness differentiation feed taking behavioral experiments in Experiment 1 of the present invention.

[Figure 2] A graph indicating the number of correct responses and the number of incorrect responses in the group fed the mixture of ethyl esters containing DHA and the phospholipids in Experiment 1.

[Figure 3] A graph indicating the number of correct responses and the number of incorrect responses in the group fed the ethyl ether containing DHA in Experiment 1.

[Figure 4] A graph indicating the number of correct responses and the number of incorrect responses in the control group in Experiment 1.

[Figure 5] a graph indicating the learning process (percentage of correct responses) in the Y maze light/darkness differentiation feed taking behavioral experiments in Experiment 2.

[Figure 6] A graph indicating the number of correct responses and the number of incorrect responses for the group fed the mixture of triglycerides containing DHA and the phospholipids in Experiment 2.

[Figure 7] A graph indicating the number of correct responses and the number of incorrect responses in the group fed the esters containing DHA in Experiment 2.

[Figure 8] A graph indicating the number of correct responses and the number of incorrect responses in the control group in Experiment 2.

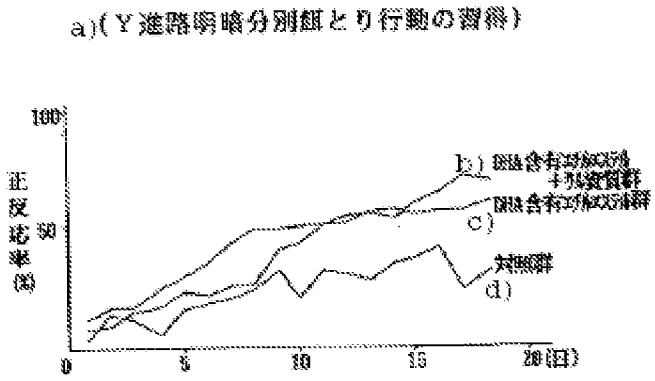
[Figure 9] A graph indicating the learning process (percentage of correct responses) in the Y maze light/darkness differentiation feed taking behavioral experiments in Experiment 3.

[Figure 10] A graph indicating the number of correct responses and the number of incorrect responses in the group fed the phospholipids containing DHA in Experiment 3.

[Figure 11] A graph indicating the number of correct responses and the number of incorrect responses in the group fed the ethyl ester containing DHA in Experiment 3.

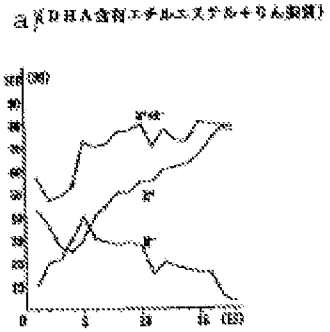
[Figure 12] A graph indicating the number of correct responses and the number of incorrect responses in the control group in Experiment 3.

Figure 1



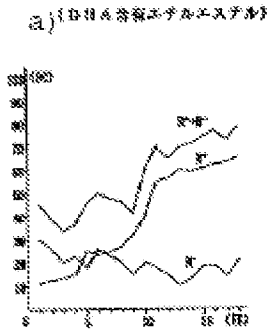
Key: a)Learning Y Maze Light/Darkness Discrimination Food Taking Behavior; b)Group fed ethyl esters containing DHA + phospholipids; c)Group fed ethyl esters containing DHA; d)Control group; y-axis)correct response rate (%); x-axis)(days)

Figure 2



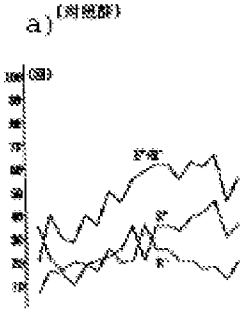
Key: a)Ethyl esters containing DHA and phospholipids; y-axis)(times); x-axis)(days)

Figure 3



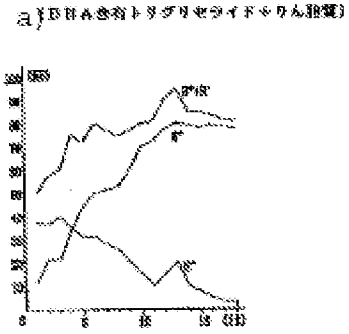
Key: a)ethyl esters containing DHA; y-axis)(times); x-axis)(days)

Figure 4



Key: a)control group; y-axis)(times)

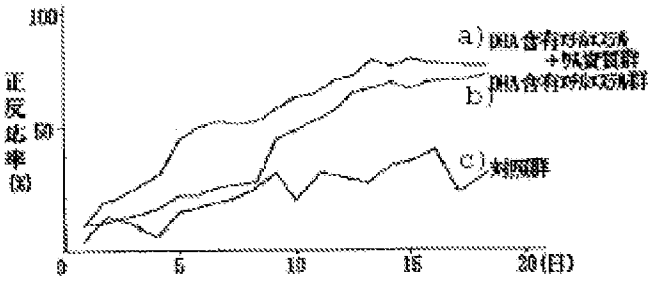
Figure 6



Key: a)triglycerides containing DHA and phospholipids;

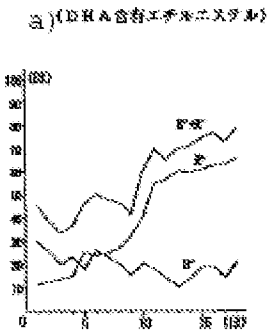
y-axis)(times); x-axis)(days)

Figure 5



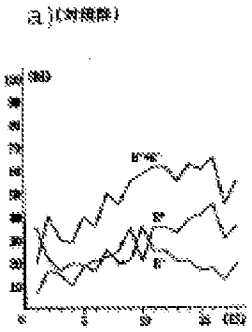
Key: a)Group fed ethyl esters containing DHA and phospholipids; b)Group fed ethyl esters containing DHA; c)Control group; y-axis)percentage of correct responses (%); x-axis)(days)

Figure 7



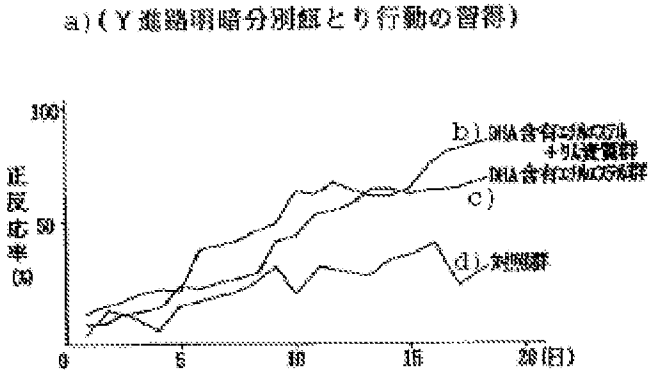
Key: a)Ethyl esters containing DHA; y-axis)(times); x-axis)(days)

Figure 8



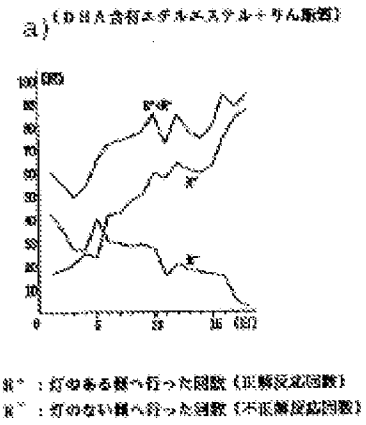
Key: a)Control Group; y-axis)(times); x-axis)(days)

Figure 9



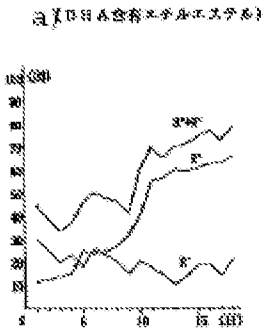
Key: a)Learning Y Passage Light/Darkness Differentiation Food-Taking Behavior; b)Group fed ethyl esters containing DHA and phospholipids; c)Group fed ethyl esters containing DHA; d)Control group; y-axis)percentage of correct responses (%); x-axis)(days)

Figure 10



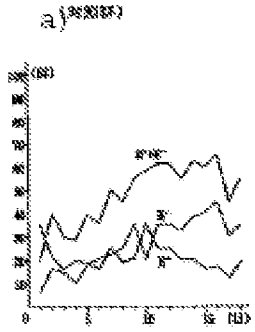
Key: a)Ethyl Esters Containing DHA and Phospholipids; y-axis)(times); x-axis)(days); R+ : number of times animal went to side with light (number of correct responses); R- : number of times animal went to side with no light (number of incorrect responses)

Figure 11



Key: a)Ethyl Esters Containing DHA; y-axis)(times); x-axis)(days)

Figure 12



Key: a)Control Group; y-axis)(times); x-axis)(days)